Department of Pesticide Regulation

dpr

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M E M O R A N D U M

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SUBJECT: EXPOSURES TO 1,3-DICHLOROPROPENE IN MONTEREY AND SANTA
           CRUZ COUNTIES BASED ON THE FALL 2001 MONITORING BY THE
           CALIFORNIA AIR RESOURCES BOARD

This memorandum gives inhalation exposures as average concentrations of 1,3 dichloropropene
(1,3-D) in air for 24-hour, 1-week and 8-week averaging periods, based on monitoring done by
the California Air Resources Board in Monterey and Santa Cruz Counties in Fall 2001 (ARB,
2002). This memorandum replaces HSM-02011, which reported concentrations calculated
substituting one-half the limit of quantitation (LOQ) for measurements above the limit of
detection (LOD) and below the LOQ. The more standard practice of substituting the mid-point
between the LOD and LOQ has been used in the present memorandum, resulting in small
changes only in the 95 percent tolerance limits for days.

Methods

Following the practice of the Worker Health and Safety (WHS) Branch, this memorandum
reports arithmetic mean concentrations and tolerance limits estimated using lognormal methods.
Lognormality is assumed for environmental contaminants in most cases. DPR's experience with
many large environmental datasets has shown that they are usually well described by the
lognormal distribution. In addition, WHS prefers to avoid the inconsistency of using different
exposure statistics based on sample characteristics. WHS uses the arithmetic mean concentration
because the concentration of interest for exposure assessment is the overall concentration in all
of the air that a person could breathe during the averaging period. The arithmetic mean
concentration is the best estimate of the average mass of residue per unit of environmental
medium; it is equivalent to compositing all of the samples and measuring the concentration of
the mixture (Parkhurst, 1998). This is true regardless of the shape of the underlying distribution.

Of 233 samples, 32 samples were below the limits of detection (LOD) for both cis- and trans-
1,3-D (the LODs were 0.002 and 0.003 ppbv, respectively); 136 samples contained quantifiable
concentrations of both cis- and trans-1,3-D (the limits of quantitation (LOQ) were 0.010 and
0.014 ppbv, respectively). Before the cis- and trans- concentrations were summed to get total
1,3-D for each sample, one-half the LOD was substituted for an isomer below the LOD, and the
mid-point between the LOD and LOQ was substituted for an isomer below the LOQ. Twenty
samples with flow-rate deviations greater than 25% were excluded from the analysis. When
there were two samples taken at a site on the same day, the arithmetic mean of the two values
was used. There were ten instances in which a site had usable samples for only two days in a

week, and one other in which there was only one sample. There was no detectable cis- or trans-1,3-D in 4 background samples. The data were not adjusted for recovery (average 92% in 8 laboratory spikes, 92% in 8 trip spikes and 84% in 8 field spikes).

24-hr exposure

For each monitoring site separately, the maximum observed and the 95% tolerance limit for 24-hr concentrations are given. The 95% tolerance limit is the concentration that, with given probability, will be exceeded in 5% of future samples (Hahn and Meeker, 1991). It is calculated using lognormal distribution methods:

$\quad$ 95% tolerance limit = exp{arithmetic mean of log concentrations + $g_{(.90;.95;\,n)}$*(sd of logs)}.

The multiplier g for 90% probability is tabled in Hahn and Meeker (1991).

1-week exposure

For each monitoring site separately, the maximum and the 95% tolerance limit for weekly mean concentrations are given. Each weekly mean is calculated as the arithmetic mean of the 24-hr samples taken at a site during the week (i.e., nonmonitoring days are ignored). The 95% tolerance limit for weekly mean concentrations is calculated using normal distribution methods:

$\quad$ 95% tolerance limit = arithmetic mean of week means + $g_{(.90;.95;\,n)}$*(sd of week means).

Normal methods are used in this case because sample means from any distribution tend to be normally distributed.

8-week exposure

For each monitoring site separately, average exposure over the 8-week monitoring period is calculated as the arithmetic mean of the weekly means (calculated as above for 1-week exposure).

Results

Twenty-four-hour, 1-week and 8-week concentrations are presented in Table 1. Daily concentrations and intermediate calculations are shown in Table 2.

Table 1. 1,3-dichloropropene concentrations (ppbv) in Monterey and Santa Cruz Counties, 8 September – 7 November 2001, based on monitoring by the California Air Resources Board.

Site [a]	N days	Daily Maximum 24-hr	Daily 95% tolerance limit	1-week Maximum weekly [b] mean	1-week 95% tolerance limit	8-week Mean of weekly means
		-----------	-----------	ppbv -----------	-----------	-----------
CHU	29	0.40	0.45	0.20	0.23	0.05
LJE	32	1.08	0.48	0.29	0.34	0.07
MES	26	4.17	3.53	1.32	1.45	0.25
PMS	30	0.92	0.62	0.27	0.31	0.09
SAL	31	0.32	0.62	0.10	0.16	0.05
SES	25	0.23	0.34	0.09	0.12	0.04

a Monitoring sites described in ARB (2002).
b Each weekly mean is the arithmetic mean of the 24-hr samples (*n* ranged 1-6) in a calendar week.

Exposure appraisal

The average concentrations presented here are based on limited monitoring data and must be considered as having some degree of uncertainty. The representativeness of the six monitoring sites is unknown. Each site was monitored 1 - 6 days per week for a relatively short (8-week) period. Weekend days were not monitored. It is unknown whether weekdays and weekends differ systematically in numbers of 1,3-D fumigations.

References

ARB. 2002. Ambient air monitoring for methyl bromide and 1,3-dichloropropene in Monterey and Santa Cruz Counties, Fall 2001. Report dated Mar. 29, Project No. P-01-004. Sacramento, CA: Quality Management Branch, Monitoring and Laboratory Division, Air Resources Board, California Environmental Protection Agency.

Hahn, G.J., and Meeker, W.Q. 1991. *Statistical Intervals: A Guide for Practitioners*. New York, John Wiley & Sons, Inc.

Parkhurst, D.F. 1998. Arithmetic versus geometric means for environmental concentration data. *Environmental Science and Technology News*. Feb. 1.

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Table 2. Daily concentrations and intermediate calculations for Monterey/Santa Cruz County sites.

Day	Week	ppbv CHU	LJE	MES	PMS	SAL	SES	ln ppbv CHU	LJE	OAS	PMS	SAL	SES
8-Sep-01	1	0.002	0.006	0.002	0.002	0.002	0.002	-6.04	-5.04	-6.04	-6.04	-6.04	-6.04
9-Sep-01	1	0.002	0.002	0.162	0.012	0.002	0.017	-6.04	-6.04	-1.82	-4.43	-6.04	-4.06
10-Sep-01	1	0.002	0.002			0.002		-6.04	-6.04			-6.04	
11-Sep-01	1		0.002						-6.04				
1 Average		**0.002**	**0.003**	**0.082**	**0.007**	**0.002**	**0.010**						
17-Sep-01	2	0.007	0.002	0.043	0.038	0.015	0.039	-4.94	-6.04	-3.15	-3.26	-4.17	-3.25
18-Sep-01	2	0.002	0.002	0.045	0.053	0.002	0.070	-6.04	-6.04	-3.11	-2.93	-6.04	-2.66
2 Average		**0.005**	**0.002**	**0.044**	**0.046**	**0.009**	**0.054**						
22-Sep-01	3	0.012	0.012	0.090	0.039	0.012	0.232	-4.43	-4.43	-2.41	-3.25	-4.43	-1.46
23-Sep-01	3	0.012	0.012	0.051	0.058	0.002	0.069	-4.43	-4.43	-2.97	-2.85	-6.04	-2.67
24-Sep-01	3	0.087	0.012	1.298	0.074	0.133	0.002	-2.44	-4.43	0.26	-2.60	-2.02	-6.04
25-Sep-01	3	0.012	0.027	4.168	0.925	0.084	0.078	-4.43	-3.63	1.43	-0.08	-2.48	-2.56
26-Sep-01	3	0.065	0.012	0.689	0.174	0.031	0.114	-2.74	-4.43	-0.37	-1.75	-3.49	-2.17
27-Sep-01	3	0.045	0.162	1.605	0.338	0.204	0.043	-3.10	-1.82	0.47	-1.08	-1.59	-3.16
3 Average		**0.039**	**0.039**	**1.317**	**0.268**	**0.078**	**0.090**						
3-Oct-01	4	0.017	0.029	0.012	0.012	0.012	0.012	-4.10	-3.54	-4.43	-4.43	-4.43	-4.43
4-Oct-01	4		0.012	0.065	0.039	0.002	0.012		-4.43	-2.74	-3.25	-6.04	-4.43
5-Oct-01	4	0.080	0.012	0.086	0.048	0.002	0.031	-2.53	-4.43	-2.45	-3.03	-6.04	-3.48
6-Oct-01	4	0.073	0.041	0.390	0.055	0.321	0.012	-2.61	-3.18	-0.94	-2.89	-1.13	-4.43
4 Average		**0.057**	**0.024**	**0.138**	**0.039**	**0.085**	**0.017**						
11-Oct-01	5	0.017	0.031	0.086	0.105	0.055	0.012	-4.05	-3.48	-2.45	-2.26	-2.89	-4.43
12-Oct-01	5	0.035	0.066		0.134	0.110		-3.35	-2.72		-2.01	-2.21	
13-Oct-01	5	0.082	0.062		0.138	0.129		-2.50	-2.78		-1.98	-2.05	
14-Oct-01	5	0.048	0.018	0.381	0.106	0.050		-3.03	-4.00	-0.97	-2.24	-3.00	
5 Average		**0.046**	**0.044**	**0.233**	**0.121**	**0.086**	**0.012**						
19-Oct-01	6	0.103	0.033	0.199	0.047	0.110	0.106	-2.28	-3.41	-1.62	-3.05	-2.21	-2.25
20-Oct-01	6		0.043	0.034	0.042	0.012	0.025		-3.14	-3.38	-3.18	-4.43	-3.69
21-Oct-01	6	0.025	0.012	0.091	0.047	0.012	0.019	-3.70	-4.43	-2.40	-3.05	-4.43	-3.97
22-Oct-01	6	0.049	1.077	0.177	0.106	0.012	0.038	-3.02	0.07	-1.73	-2.24	-4.43	-3.26
6 Average		**0.059**	**0.291**	**0.125**	**0.061**	**0.036**	**0.047**						

continued

Table 2. Continued.

Day	Week	ppbv							ln ppbv					
		CHU	LJE	MES	PMS	SAL	SES		CHU	LJE	OAS	PMS	SAL	SES
27-Oct-01	7	0.098	0.140	0.066	0.012	0.105	0.012		-2.33	-1.97	-2.72	-4.43	-2.26	-4.43
28-Oct-01	7	0.039	0.103	0.047	0.012	0.092			-3.26	-2.27	-3.05	-4.43	-2.39	
29-Oct-01	7	0.265	0.146	0.056	0.370	0.104	0.012		-1.33	-1.92	-2.88	-0.99	-2.26	-4.43
30-Oct-01	7	0.402	0.096		0.032	0.079	0.012		-0.91	-2.34		-3.43	-2.54	-4.43
7 Average		**0.201**	**0.121**	**0.057**	**0.107**	**0.095**	**0.012**							
4-Nov-01	8	0.047	0.030		0.019	0.018			-3.05	-3.52		-3.99	-4.04	
5-Nov-01	8	0.012	0.040	0.012	0.037	0.012	0.012		-4.43	-3.22	-4.43	-3.28	-4.43	-4.43
6-Nov-01	8	0.012	0.018	0.039	0.046	0.012	0.078		-4.43	-4.04	-3.24	-3.08	-4.43	-2.55
7-Nov-01	8	0.012	0.036	0.044	0.059	0.019	0.084		-4.43	-3.31	-3.12	-2.84	-3.96	-2.48
8 Average		**0.021**	**0.031**	**0.032**	**0.040**	**0.015**	**0.058**							
Grand Average		0.057	0.072	0.382	0.106	0.057	0.046							
Mean of week means		**0.054**	**0.070**	**0.253**	**0.086**	**0.051**	**0.037**		-3.66	-3.72	-2.17	-2.95	-3.73	-3.55
SD of week means		0.063	0.097	0.435	0.082	0.039	0.029		1.37	1.43	1.62	1.18	1.56	1.15
Max of week means		**0.201**	**0.291**	**1.317**	**0.268**	**0.095**	**0.090**		29	32	26	30	31	25
n weeks		8	8	8	8	8	8							
95th %ile of week means		0.17	0.253	1.077	0.2	0.12	0.09							
90% tol limit on 95th%		**0.228**	**0.337**	**1.450**	**0.313**	**0.158**	**0.118**		est pop 95th %ile of days					
									0.267	0.275	1.814	0.392	0.339	0.206
Max of days		**0.402**	**1.077**	**4.168**	**0.925**	**0.321**	**0.232**		**0.454**	**0.477**	**3.532**	**0.615**	**0.616**	**0.335**
										90% tol limit on95th%ile of days				